I CLAIM:

1. A system for assisting a pilot flying an aircraft having solid state gyros and a turn coordinator gyro on-board, comprising:

means on-board the aircraft for obtaining a continuous determination of the aircraft's altitude from satellite-based radio navigation signals;

means on-board the aircraft for obtaining a continuous determination of the aircraft's attitude from satellite-based radio navigation signals and from said solid state gyros on-board the aircraft;

means on-board the aircraft for determining the roll rate of the aircraft from satellite-based radio navigation signals and from said solid state gyros and said turn coordinator gyro on-board the aircraft;

data processing means on-board the aircraft for processing said altitude, attitude and roll rate determinations;

and means on-board the aircraft responsive to said data processing means for providing corrective voice messages to the pilot.

2. A system according to claim 1, wherein said data processing means includes means for detecting the magnitude and direction of any excessive altitude excursion of the aircraft in a predetermined time interval, and means for detecting any excessive roll rate of the aircraft;

and said means for providing corrective voice messages to the pilot produces a first series of corrective voice messages when the aircraft has both an excessive roll rate and an excessive altitude excursion downward, and a second series of corrective voice

messages, different from the first, when the aircraft has both an excessive roll rate and an excessive altitude excursion upward.

3. A system according to claim 1, wherein said data processing means comprises:

a safe altitude/approach database for the terrain over which the aircraft is flying;

and computer means for comparing said continuous altitude determination against said database to initiate a voice warning to the pilot when the aircraft is at an unsafe altitude.

4. A system according to claim 3, and further comprising: means for disabling the comparison of said continuous altitude determination against said database when the aircraft is within a predetermined approach distance to an airport.

5. A system according to claim 2, wherein said data processing means also comprises:

a safe altitude/approach database for the terrain over which the aircraft is flying;

and means for comparing said continuous altitude determination against said database to initiate a voice warning to the pilot when the aircraft is at an unsafe altitude.

6. A system according to claim 5, and further comprising: means for disabling the comparison of said continuous altitude determination against said database when the aircraft is within a predetermined approach distance to an airport.

7. A system according to claim 2, wherein said first series of messages is initiated when the aircraft is nose-low and instructs the pilot: first, to reduce the aircraft engine power; next, to level the wings; and, after that, to raise the aircraft nose and increase engine power to establish a climb.

8. A system according to claim 2, wherein said second series of messages is initiated when the aircraft is nose-high and instructs the pilot: first, to increase the aircraft engine air power; next, to lower the aircraft nose; and, after that, to level the wings.

9. A system according to claim 2, wherein:

said first series of messages is initiated when the aircraft is nose-low and instructs the pilot: first, to reduce the aircraft engine power; next, to level the wings; and, after that, to raise the aircraft nose and increase engine power to establish a climb;

and said second series of messages is initiated when the aircraft is nose-high and instructs the pilot: first, to increase the aircraft engine air power; next, to lower the aircraft nose; and, after that, to level the wings.

10. A system according to claim 5, wherein:

said first series of messages is initiated when the aircraft is nose-low and instructs the pilot: first, to reduce the aircraft engine power; next, to level the wings; and, after that, to gently raise the aircraft nose and increase engine power to establish a climb;

and said second series of messages is initiated when the aircraft is nose-high and instructs the pilot: first, to increase the aircraft engine air power; next, to lower the aircraft nose; and, after that, to level the wings.

11. A system according to claim 10, and further comprising: means for disabling the comparison of said continuous altitude determination against said database when the aircraft is within a predetermined approach distance to an airport.

12. A system according to claim 9 and further comprising: a stereo headset with left and right earpieces worn by the pilot and operative to receive said voice signals, and wherein:

said first series of signals includes leveling messages only to the earpiece of said headset corresponding to the low wing;

and said second series of signals includes leveling messages only to the earpiece of said headset corresponding to the low wing.

13. A system according to claim 10 and further comprising: a stereo headset with left and right earpieces worn by the pilot and operative to receive said voice signals, and wherein:

said first series of signals includes leveling messages only to the earpiece of said headset corresponding to the low wing;

and said second series of signals includes leveling messages only to the earpiece of said headset corresponding to the low wing.

14. A system according to claim 1, and further comprising:

a vacuum pressure sensor on-board the aircraft operatively connected to sense a partial failure of the aircraft's instrument panel;

and wherein said data processing means is operatively connected to said receiver to determine the aircraft's heading from satellite-based radio navigation signals and is operatively connected to said vacuum pressure sensor to initiate voice instructions to the pilot, said data processing means being programmed to time said satellite-based radio

navigation signals which tell the aircraft's heading and to provide a timed turns voice instruction routine to the pilot.

15. A system according to claim 13, and further comprising:

a vacuum pressure sensor on-board the aircraft operatively connected to sense a partial failure of the aircraft's instrument panel;

and wherein said data processing means is operatively connected to said receiver to determine the aircraft's heading from satellite-based radio navigation signals and is operatively connected to said vacuum pressure sensor to initiate voice instructions to the pilot via said headset, said data processing means being programmed to time said satellite-based radio navigation signals which tell the aircraft's heading and to provide a timed turns voice instruction routine to the pilot via said headset.

16. A system for assisting an aircraft pilot wearing a headset and flying an aircraft with a GPS-enabled receiver and an instrument panel on-board, comprising:

a vacuum pressure sensor on-board the aircraft operatively connected to sense a partial failure of the instrument panel;

and a computer on-board the aircraft operatively connected to said GPS-enabled receiver to determine the aircraft's heading from GPS signals and operatively connected to said vacuum pressure sensor to initiate voice instructions to the pilot via said headset, said computer being programmed to time said GPS signals which tell the aircraft's heading and to provide a timed turns voice instruction routine to the pilot via said headset.

17. A method of assisting a pilot flying an aircraft having solid state gyros and a turn coordinator gyro on-board, comprising the steps of:

obtaining a continuous determination of the aircraft's altitude from satellite-based radio navigation signals;

obtaining a continuous determination of the aircraft's attitude from satellite-based radio navigation signals and from said solid state gyros on-board the aircraft;

determining the roll rate of the aircraft from satellite-based radio navigation signals and from said solid state gyros and said turn coordinator gyro on-board the aircraft;

processing said altitude, attitude and roll rate determinations;

and providing corrective voice messages to the pilot.

18. A method according to claim 17, wherein said processing step includes:

detecting the magnitude and direction of any excessive altitude excursion of the aircraft in a predetermined time interval, and detecting any excessive roll rate of the aircraft;

and said step of providing corrective voice messages to the pilot produces a first series of corrective voice messages when the aircraft has both an excessive roll rate and an excessive altitude excursion downward, and a second series of corrective voice messages, different from the first, when the aircraft has both an excessive roll rate and an excessive altitude excursion upward.

19. A method according to claim 17, wherein said processing step comprises:

comparing said continuous altitude determination against a safe altitude/approach database for the terrain over which the aircraft is flying, and initiating a voice warning to the pilot when the aircraft is at an unsafe altitude.

20. A method according to claim 19, and further comprising the step of disabling the comparison of said continuous altitude determination against said database when the aircraft is within a predetermined approach distance to an airport.

21. A method according to claim 18, wherein said processing step comprises:

comparing said continuous altitude determination against a safe altitude/approach database for the terrain over which the aircraft is flying and initiating a voice warning to the pilot when the aircraft is at an unsafe altitude.

22. A method according to claim 21, and further comprising the step of disabling the comparison of said continuous altitude determination against said database when the aircraft is within a predetermined approach distance to an airport.

23. A method according to claim 18, wherein said first series of messages is initiated when the aircraft is nose-low and instructs the pilot: first, to reduce the aircraft engine power; next, to level the wings; and, after that, to gently raise the aircraft nose and increase engine power to establish a climb.

24. A method according to claim 18, wherein said second series of messages is initiated when the aircraft is nose-high and instructs the pilot: first, to increase the aircraft engine air power; next, to lower the aircraft nose; and, after that, to level the wings.

25. A method according to claim 18, wherein:

said first series of messages is initiated when the aircraft is nose-low and instructs the pilot: first, to reduce the aircraft engine power; next, to level the wings; and, after that, to gently raise the aircraft nose and increase engine power to establish a climb;

and said second series of messages is initiated when the aircraft is nose-high and instructs the pilot: first, to increase the aircraft engine air power; next, to lower the aircraft nose; and, after that, to level the wings.

26. A method according to claim 21, wherein:

said first series of messages is initiated when the aircraft is nose-low and instructs the pilot: first, to reduce the aircraft engine power; next, to level the wings; and, after that, to gently raise the aircraft nose and increase engine power to establish a climb;

and said second series of messages is initiated when the aircraft is nose-high and instructs the pilot: first, to increase the aircraft engine air power; next, to lower the aircraft nose; and, after that, to level the wings.

27. A method according to claim 26, and further comprising the step of disabling the comparison of said continuous altitude determination against said database when the aircraft is within a predetermined approach distance to an airport.

28. A method according to claim 25 wherein:

said first series of signals includes leveling messages only to the pilot's ear corresponding to the low wing;

and said second series of signals includes leveling messages only to the pilot's ear corresponding to the low wing.

29. A method according to claim 26 wherein:

said first series of signals includes leveling messages only to the pilot's ear corresponding to the low wing;

and said second series of signals includes leveling messages only to the pilot's ear corresponding to the low wing.

30. A method according to claim 17, and further comprising the steps of:

sensing a partial failure of the aircraft's instrument panel from a vacuum pressure sensor on-board the aircraft;

determining the aircraft's heading from satellite-based radio navigation signals and initiating voice instructions to the pilot;

timing said satellite-based radio navigation signals which tell the aircraft's heading;

and providing timed turns voice instruction routine to the pilot.

31. A method according to claim 29, and further comprising the steps of:

sensing a partial failure of the aircraft's instrument panel from a vacuum pressure sensor on-board the aircraft;

determining the aircraft's heading from satellite-based radio navigation signals and said solid state gyros, and initiating voice instructions to the pilot;

timing said satellite-based radio navigation signals and solid state gyros which tell the aircraft's heading;

and providing timed turns voice instruction routine to the pilot.

32. A method of assisting an aircraft pilot wearing a headset and flying an aircraft with solid state gyros, a GPS-enabled receiver and an instrument panel on-board, comprising the steps of:

sensing a partial failure of the instrument panel from a vacuum pressure sensor on-board the aircraft;

determining the aircraft's heading from GPS signals and said solid state gyros ;

initiating voice instructions to the pilot;

timing said GPS signals and solid state gyros which tell the aircraft's heading;

and providing timed turns voice instruction routine to the pilot.